A Dedicated Proton Linac for $\bar{p}$ - Physics at FAIR

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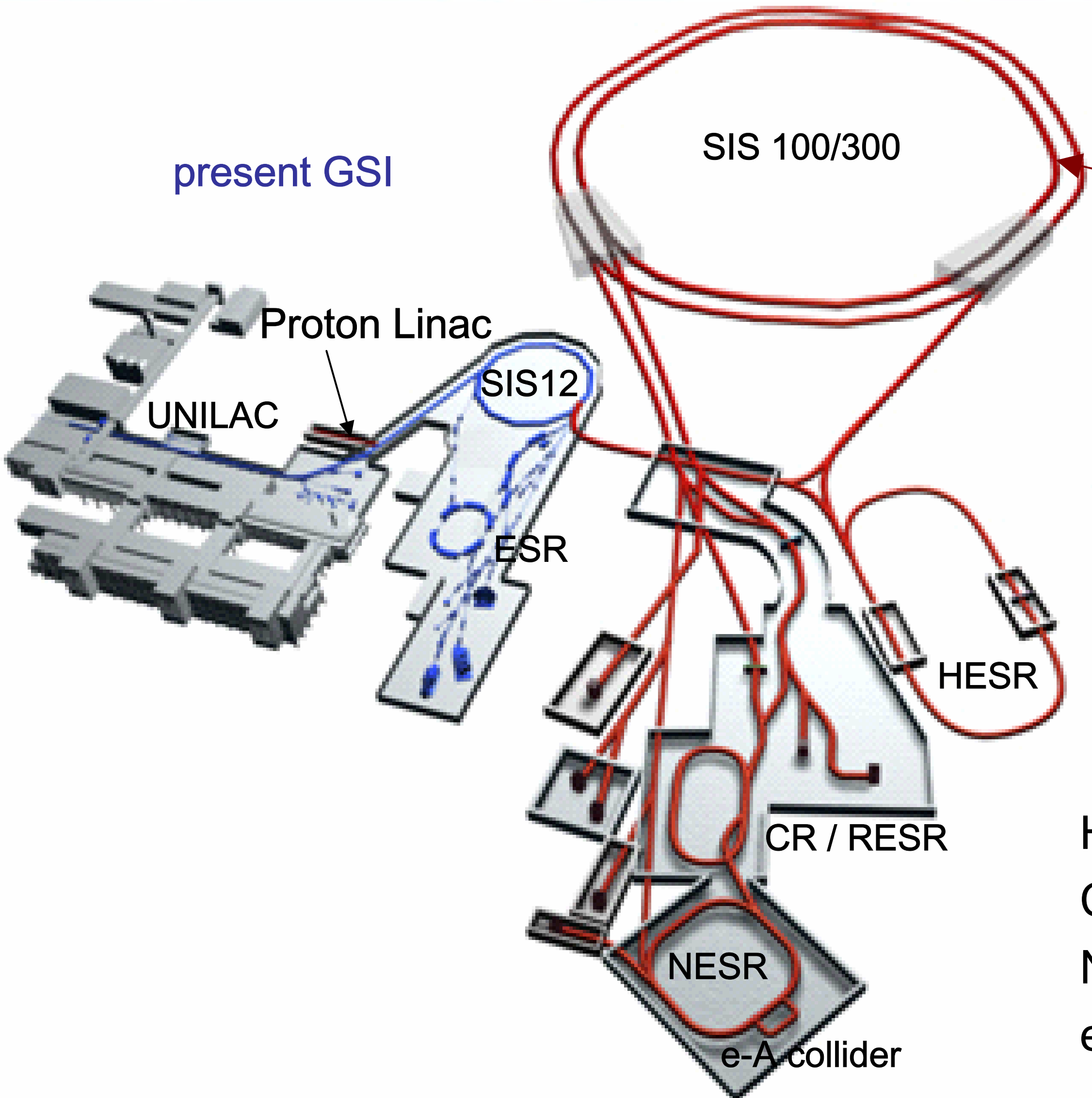
- The Fair project and its need of antiprotons
- Proton linac parameters
- Components of the proton linac

FAIR: Facility for Antiproton and Ion Research



- RIBs
- pbar
- Plasma Physics
- HE-Physics
- Atomic Physics

$7 \cdot 10^{10}$ cooled pbar/h required

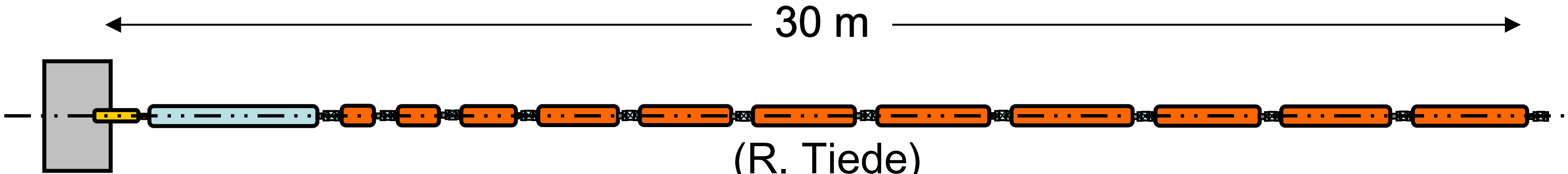
HESR: pbar

CR / RESR: RIBs, pbar

NESR: RIBs, pbar, Atomic Physics

e-A collider: Atomic Physics

FAIR p-Linac : Basic Parameters



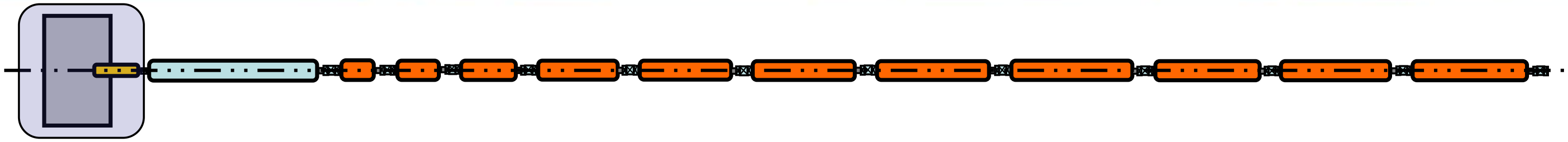
95 keV 3 MeV

70 MeV
70 mA (operating)
90 mA (design)

compact, pulsed rt p-linac:

Beam energy	70 MeV
Rf acceleration	
Accelerating structure	RFQ, CH-DTL
Operation frequency	352 MHz
Rf-pulse length	250 μs
Max. beam pulse length	100 μs
Max. repetition rate	5 Hz
Accelerator length	≈ 30 m
Beam parameters	
Operating pulse current	70 mA
Design pulse current	90 mA
Beam pulse length	0.1 ms
Trans. tot. emitt. (norm.)	2.8 mm mrad
Tot. momentum spread	$\pm 5*10^{-4}$

FAIR p-Linac : Source + LEBT



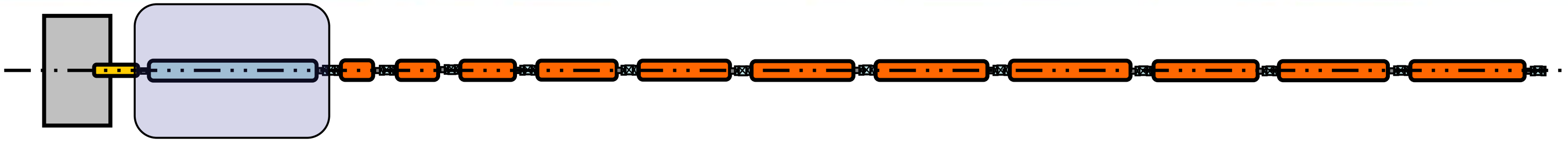
Source type	H^+ ECR
Proton energy	95 keV
Proton current	110 mA
Max. rep. rate	5 Hz
Pulse length	1 ms

LEBT type	2-Solenoid
Mass analysis	TOF
Exit proton current	100 mA
Exit emittance	0.3 µm (rms)

Beam parameters following SILHI source at CEA/Saclay

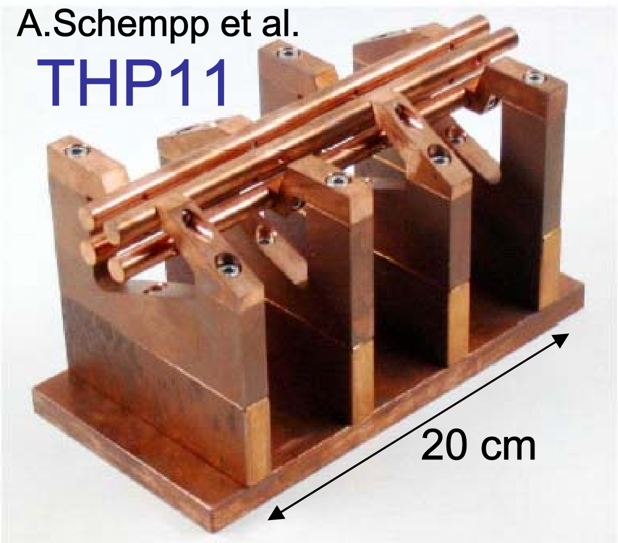
R. Gobin et al., *Saclay High Intensity Light Ion Source Status*, EPAC2002

FAIR p-Linac : RFQ



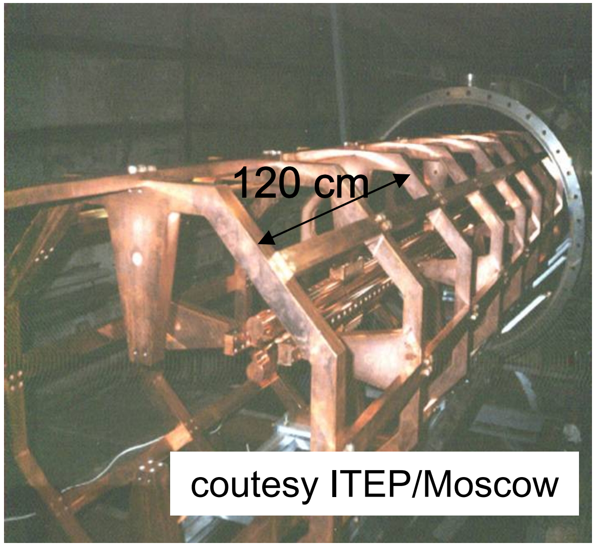
two RFQ types considered:

4-rod



frequency	352 MHz
entr. energy	95 keV
entr. current	100 mA
exit energy	3 MeV
exit current	90 mA
exit emitt (rms)	0.4 µm 150 keV deg

4-vane (windows)

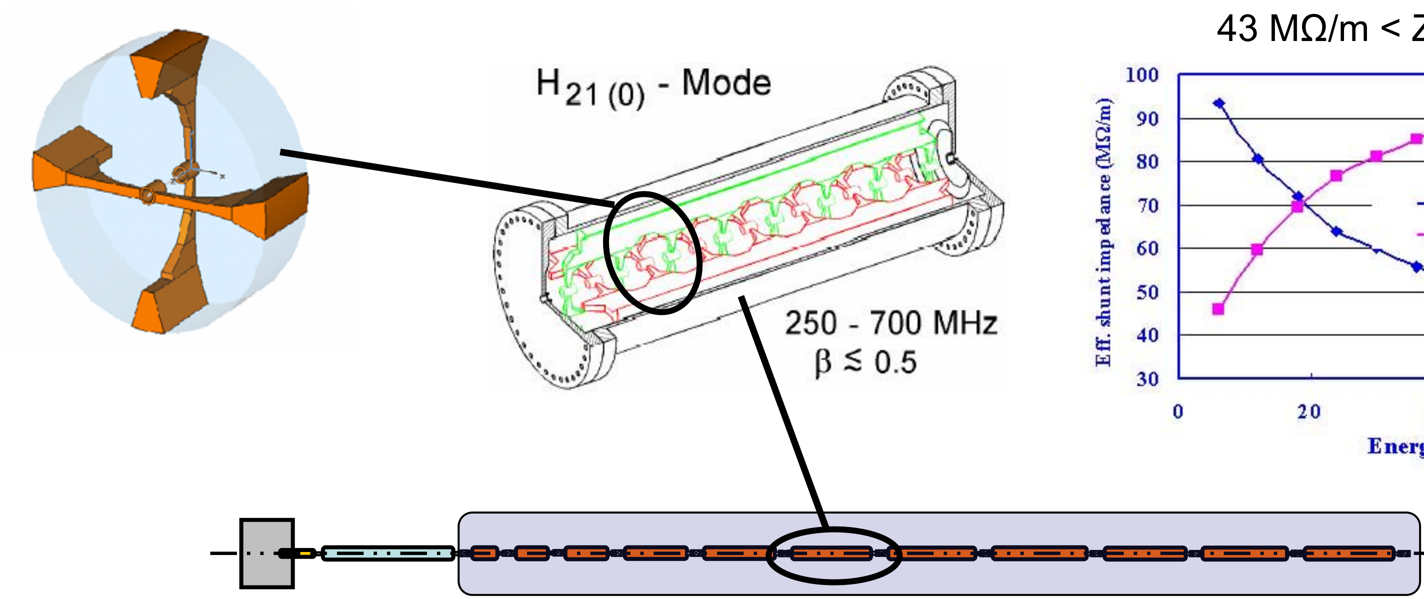


- high experience at Frankfurt Univ.
- lower costs
- never built for 352 MHz

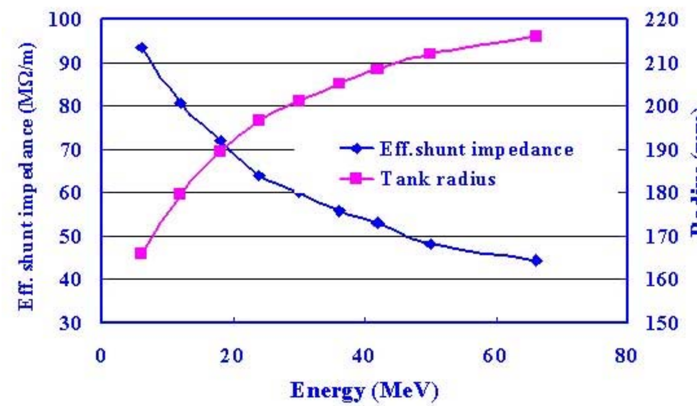
- standard type for f ≥ 300 MHz
- higher mechanical stability
- higher costs

FAIR p-Linac : DTL - Section

DTL based on 11 Crossed-bar H-cavities (CH): Z. Li et al. MOP20



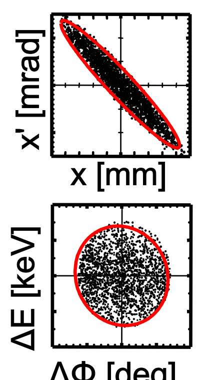
43 MΩ/m < Z_{eff} < 100 MΩ/m

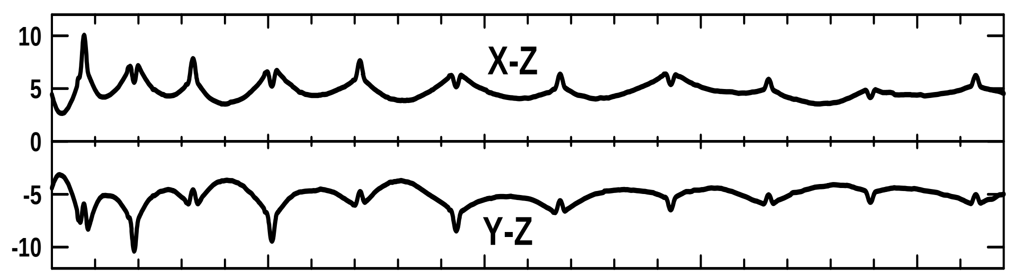


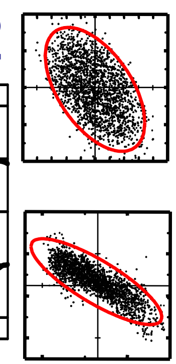
CH-DTL beam dynamics: R.Tiede et al. MOP12

1.5 µm

200 keV deg







1.9 µm

440 keV deg